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DESCRIPTION

FALSE-TWISTING DISK

Technical field

The present invention relates to a false-twisting disk used in a friction false twister for crimping various fibers including synthetic materials such as nylon and polyester.

Background Art

The following false-twisting disk has been known as a conventional false-twisting disk; a false-twisting disk made of a single material such as ceramics; a false-twisting disk in which a friction ring made of a urethane rubber is integrally fixed on the outer periphery of a disk body made of a synthetic resin such as polyacetal by arranging the disk body in a metal mold having a prescribed shape, and injecting and curing liquid urethane; and a false-twisting disk in which a disk body is mounted in a metal mold having a prescribed shape, and the friction ring is integrally formed on the outer periphery of the disk body by an injection molding machine.

However, when the friction ring is integrally fixed to the disk body as described above, the friction ring cannot be separated from the disk body when the friction ring is worn by use. Thereby, the false-twisting disk itself is replaced

with a new disk, and the old false-twisting disk must be abandoned. Therefore, the cost of the false-twisting disk associated with the false-twisting of the raw yarn increases. In addition, the abandonment process of the disk used becomes a problem and the effective utilization of the resource is not achieved. Therefore, for addressing the above problems, a false-twisting disk has been developed, in which a friction ring is fitted in the outer periphery of a disk body.

Particularly, as shown in Fig. 11, a false-twisting disk 73 has been known, in which a friction ring 72 which has an inner diameter being smaller than the outer diameter of a disk body 71 and is made of a urethane rubber is mounted on the outer periphery of the disk body 71 (see Japanese Published Unexamined Patent Application (KOKAI) No. Sho-51-53148). As shown in Fig. 12, a false-twisting disk 84 has been known, in which a recessed groove 82 of which the width is wider from the bottom toward an opening is formed on the outer periphery of a disk body 81, and a rubber ring 83 is fitted in the recessed groove 82 (see Japanese Utility Model Publication No. Sho-59-10136).

In the false-twisting disks 73 and 84, the friction rings 72 and 83 with rubber elasticity are basically fitted in the outer periphery of the disk bodies 71 and 81. Thereby, when the friction rings 72 and 83 are worn, only the friction rings

72 and 83 can be replaced.

However, the false-twisting disk 73 has a structure in which the friction ring 72 is merely press-contacted with the smooth outer periphery of the disk body 71 among the false-twisting disks 73 and 84 described above. The false-twisting disk 84 has a structure in which the friction ring 83 is fitted in a recessed groove 82 of which the width of the opening side is wide in the outer periphery of the disk body 81, and the friction rings 72 and 83 are not fixedly mounted on the outer periphery of the disk bodies 71 and 81. Thereby, the accommodating force of the friction rings 72 and 83 to the disk bodies 71 and 81 decreases by the stress relaxation of the friction rings 72 and 83 in the friction false twister when the false-twisting disks 73 and 84 are rotated at a high speed, and the friction rings 72 and 83 may deviate or come off on the outer periphery of the disk bodies 71 and 81 by the centrifugal force associated with the high speed rotation.

It is an object of the present invention to provide a false-twisting disk in which only the friction ring can be replaced when the friction ring is worn away, and the friction ring may not deviate and come off from the disk body at high-speed rotation in the false-twisting.

Disclosure of the Invention

In accordance with a first aspect of the invention, provided is a false-twisting disk provided with a friction ring with rubber elasticity on the outer periphery of the disk body having an axis hole in the center thereof, wherein a dovetail groove is formed on the outer periphery of the disk body, and a projected line fitted in the dovetail groove is provided on the inner periphery of the friction ring.

It is preferable that the width of the projected line of the friction ring is equal to the width of the opening of the dovetail groove formed on the outer periphery of the disk body, or is slightly wider than the width of the opening. Particularly, when the hardness of the friction ring is set comparatively high within the range to be described below, the width of the projected line is almost equal to that of the opening of the dovetail groove. When the hardness of the friction ring is set comparatively low within the range to be described below, the width of the projected line is slightly wider than that of the opening of the dovetail groove, and thereby the friction ring is pushed into the dovetail groove while the friction ring is transformed in the opening of the dovetail groove. Therefore, the disk body is firmly fitted in the friction ring.

It is preferable that the height of the projected line provided on the inner periphery of the friction ring is equal

to the depth of the dovetail groove of the disk body outer periphery, or is slightly higher than the depth of the dovetail groove. Particularly, the height of the projected line is almost equal to the depth of the dovetail groove when the hardness of the friction ring is set comparatively high within the range to be described below. When the hardness of the friction ring is set comparatively low within the range to be described below, the height of the projected line is slightly higher than the depth of the dovetail groove. When the projected line is pushed into the dovetail groove, the end part of projected line is slightly expanded in the bottom of the dovetail groove in the width direction, and the friction ring is firmly fitted in the disk body.

In accordance with a second aspect of the invention, provided is a false-twisting disk provided with a friction ring with rubber elasticity on the outer periphery of the disk body having an axis hole in the center thereof, wherein a recessed groove is formed on the outer periphery of the disk body, and one or a plurality of projections for preventing a friction ring from falling off is provided on the opening sides of the both side walls of the recessed groove, and a projected line fitted in the recessed groove is provided on the inner periphery of the friction ring.

In accordance with a third aspect of the invention, there is provided a false-twisting disk as set forth in the second aspect of the invention, wherein the projection for preventing a friction ring from falling off is formed approximately in a semicircular shape in a cross section or approximately in a triangular shape in a cross section.

The projections for preventing a friction ring from falling off in the second aspect and third aspect may be provided over the entire periphery of the disk body. In addition, a plurality of projections may be provided with predetermined intervals in a circumferential direction.

In accordance with a fourth aspect of the invention, the provided is a false-twisting disk provided with a friction ring with rubber elasticity on the outer periphery of the disk body having an axis hole in the center thereof, wherein a recessed groove is formed on the outer periphery of the disk body, fitting projection parts facing each other are provided on the opening sides of the both side walls of the recessed groove, and step parts for preventing a friction ring from falling off are formed on the side surfaces of the bottom part side of the recessed groove of the fitting projection parts, a projected line having a width corresponding to the space between the fitting projection parts, and a fitting head part formed on the end of the projected

line are provided on the inner periphery of the friction ring, the fitting projection part is formed approximately in a cone shape in a cross section, and can advance into the recessed groove, and the width of the foot of the mountain is wider than the width of the projected line, and a fitting part is fitted in the step part for preventing a friction ring from falling off of the recessed groove is formed on both ends of the foot of the mountain.

In accordance with a fifth aspect of the invention, there is provided a false-twisting disk as set forth in the first aspect to the fourth aspect of the invention, wherein the durometer hardness of the friction ring is within the range of A80 to A95.

Though it is preferable that the friction ring has high hardness in view of abrasion resistance and durability, elasticity and friction are required for the friction ring so as to apply an raw yarn to excellently crimp in false-twisting.

When the durometer hardness of the friction ring is lower than A80, the abrasion resistance and durability of the friction ring are insufficient, and expansion transformation and wave-like transformation are easily caused during use. In addition, inconvenience such as inferiority of elasticity recovery is generated. When the durometer hardness of the

friction ring is higher than A95, the friction property required cannot be obtained, and thereby it is preferable that the durometer hardness is within the range of A80 to A95. That is, the abrasion resistance, durability, shape stability, elasticity recovery, and friction property as the friction ring are obtained by setting the durometer hardness of the friction ring to the above range.

The surface roughness (Rz) of the friction ring is set to 4μm or less, preferably within the range of 1μm to 3μm. This reason will be described below.

That is, when the surface roughness (Rz) exceeds 4μm, the difference is easily caused in the twisted yarn characteristic of the friction ring in initial use, and a homogeneous twisted yarn is hardly obtained. Therefore, it is necessary to perform a trial run before an actual false-twisting, and smooth the surface of the friction ring. A problem is caused in that the trial run must be performed for a long time when the hardness of urethane rubber composing the friction ring is set high so as to improve the abrasion resistance of the friction ring.

On the other hand, when the surface roughness (Rz) of the friction ring is set to less than 1μm, and the surface of the friction ring is greatly smoothed, the trial run is omitted.

However, a stripe shape ruggedness is easily generated on the surface of the friction ring by being in contact with the raw yarn, and therefore, a problem is caused in that the life of the friction ring is short.

Herein, the surface roughness (Rz) means roughness of a maximum height defined in JIS-B0601 (2001 version).

In accordance with a sixth aspect of the invention, there is provided a false-twisting disk as set forth in any of the first aspect to the fifth aspect of the invention, wherein the friction ring is made of urethane rubber. That is, thermosetting urethane, thermoplastic urethane and millable urethane or the like are used as a material of the friction ring, and thermosetting liquid urethane obtained from a polyol component and isocyanate component as a raw material can be used in view of heat resistance and abrasion resistance.

Though the urethane rubber is divided roughly into a polyether urethane rubber and a polyester urethane rubber depending on the kind of polyol, the polyester urethane rubber is excellent in abrasion resistance, tear strength and oil resistance compared with the polyether urethane rubber.

The abrasion resistance, durability, and oil resistance or the like of the friction ring when the false-twisting disk is rotated at a high speed and the friction ring is continuously

in contact with a raw yarn running while drawing can be improved by using the polyester urethane rubber as a material of the friction ring.

Examples of the polyols used for the polyester urethane rubber include adipate polyester polyol, lactone polyester polyol and polycarbonate polyol. In addition, polyether polyol of a small amount may be added to the polyester polyol.

Though metals such as aluminum (containing alloy), ceramics and synthetic resins can be used as a material of the disk body of the false-twisting disk of the present invention, the synthetic resins are preferably used in overall view of cost, lightness, and strength or the like. Examples of synthetic resins composing the disk body include polycarbonate, polyamide and polyacetal. When a fiber reinforced resin obtained by mixing glass fiber or the like as a filler to the synthetic resins as a matrix is used, the shape stability and durability or the like of the disk body can be further improved.

The thermal deformation temperature (1.80 Mpa) of the disk body made of the synthetic resin is preferably 100°C or more.

In accordance with a seventh aspect of the invention, there is provided a false-twisting disk relating to the disk body in the false-twisting disk described in the first aspect

of the invention.

In accordance with an eighth aspect of the invention, there is provided a false-twisting disk relating to the disk body in the false-twisting disk described in the second aspect the invention.

In the present invention described above, the disk body and the friction ring are produced by properly using a synthetic resin forming method such as an injection molding, or a grinding process or the like.

Since the friction ring is firmly fitted in the outer periphery of the disk body in the false-twisting disks of the present invention, the friction ring will not deviate from a prescribed position at all, and will not come off by the decrease in accommodating force associated with stress relaxation even when the false-twisting disk is rotated at a high speed.

Only the friction ring is cut off from the disk body, and a new friction ring can be mounted on the disk body when the friction ring is worn away. Thereby, the cost of the false-twisting disk associated with the false-twisting can be suppressed, and the effective utilization of the resource can be achieved.

Brief description of the Drawings

Fig. 1 is a perspective view of a twisting part in a false

twister.

Fig. 2 is a sectional view of a false-twisting disk of an embodiment 1.

Fig. 3 is an enlarged sectional view of an essential portion showing the state of a false-twisting disk before the engagement of a friction ring.

Fig. 4 is an enlarged sectional view of an essential portion showing the state of a false-twisting disk after the engagement of a friction ring.

Fig. 5 is an enlarged sectional view of an essential portion showing the state of a false-twisting disk of an embodiment 2 after the engagement of a friction ring.

Fig. 6 is an enlarged sectional view of an essential portion showing the state of a false-twisting disk of an embodiment 3 after the engagement of a friction ring.

Fig. 7 is an enlarged sectional view of an essential portion showing the state of a false-twisting disk of an embodiment 4 before the engagement of a friction ring.

Fig. 8 is an enlarged sectional view of an essential portion showing the state of a false-twisting disk of an embodiment 4 after the engagement of a friction ring.

Fig. 9 is an enlarged sectional view of an essential portion showing the state of a false-twisting disk of an

embodiment 5 before the engagement of a friction ring.

Fig. 10 is an enlarged sectional view of an essential portion showing the state of a false-twisting disk of an embodiment 5 after the engagement of a friction ring.

Fig. 11 is a sectional view showing a conventional example of a false-twisting disk.

Fig. 12 is a sectional view showing another conventional example of a false-twisting disk.

Best Mode for Carrying Out the Invention

Next, embodiments of the present invention will be described with reference to the drawings.

First, a configuration of a twisting part in a friction false twister using a false-twisting disk of the present invention will be described. However, the false-twisting disk of the invention can be also diverted to a twisting part having the structure other than the twisting part to be described below or a textile machinery of another type.

Fig. 1 shows the structure of a twisting part of three-axis external contact type, using the false-twisting disk of each embodiment to be described below.

Specifically, the twisting part 1 is provided with three rotating axes 2 arranged at equal intervals in parallel with

each other, and three false-twisting disks 3 which are respectively attached to the rotating axes 2.

The false-twisting disks 3 which are respectively attached to the three different rotating axes 2 are alternately incorporated in the vertical direction between the different rotating axes 2. Finally, a raw yarn 4 is passed between the outer periphery of the false-twisting disks 3 in the three rotating axes 2, and the false-twisting disks 3 are in contact with the raw yarn 4.

(Embodiment 1)

As shown in Fig. 2 to Fig. 4, a false-twisting disk 5 of embodiment comprises a disk body 10 which is provided in the center with an axis hole 6 and is made of polybutyleneterephthalate containing glass fibers. A dovetail groove 7 is formed on the outer periphery of the disk body 10. A projected line 9 fitted into the dovetail groove 7 is provided on the inner periphery of a friction ring 8 made of urethane rubber.

In embodiment, as shown in Fig. 3, the opening W1 of the dovetail groove 7 is equal to the width W2 of the projected line 9, and the height H1 of the projected line 9 is slightly higher than the depth D1 of the dovetail groove 7. In this case, as shown in Fig. 4, the end part of the projected line

9 expands in the width direction thereof in the dovetail groove 7, and thereby the friction ring 8 can be firmly fitted into the dovetail groove 7.

(Embodiment 2)

As shown in Fig. 5, a false-twisting disk 21 of embodiment comprises a disk body 23 which is provided in the center with an axis hole (not shown) and is made of polyacetal containing glass fibers. A recessed groove 24 is formed on the outer periphery of the disk body 23. Projections 26 for preventing a friction ring from falling off which are formed in a semicircular shape in a cross section over the entire periphery are respectively provided on the opening sides of the both side walls 27 of the recessed groove 24. A projected line 25 fitted in the recessed groove 24 is provided on the inner periphery of a friction ring 28 made of urethane rubber.

In this embodiment, the width of the recessed groove 24 is equal to that of the projected line 25, and the depth of the recessed groove 24 is equal to the height of the projected line 25.

(Embodiment 3)

As shown in Fig. 6, a false-twisting disk 31 of embodiment is a modification of embodiment 2. In embodiment 2, the projections 26 for preventing a friction ring from falling off

which are formed in a semicircular shape in a cross section are respectively provided on the opening sides of the both side walls 27 of the recessed groove 24 formed on the outer periphery of the disk body 23. However, in embodiment, in place of the above configuration, three projections 32 for preventing a friction ring from falling off are respectively provided on the opening sides of the both side walls 27, and the projections 32 are formed in a triangle shape in a cross section over the entire periphery. Since the other configurations are identical to those of embodiment 2, their explanation is omitted by designating the same reference numerals.

(Embodiment 4)

As shown in Fig. 7 and Fig. 8, a false-twisting disk 41 of embodiment comprises a disk body 42 which is provided in the center with an axis hole (not shown) and is made of polycarbonate. A recessed groove 43 is formed on the outer periphery of the disk body 42. Fitting projection parts 45 are respectively provided so as to be facing each other on the opening sides of the both side walls of the recessed groove 43. Bottom part 46 side of the recessed groove of the fitting projection parts 45 are step parts 47 for preventing a friction ring from falling off. A projected line 49 having a width corresponding to a space S1 between the fitting projection parts

45, and a fitting head part 51 formed on the end of the projected line 49 are provided on the inner periphery of the friction ring 48. The fitting head part 51 is formed approximately in a cone shape in a cross section, and can advance into the recessed groove 43. The width W5 of a foot 51a of a mountain is wider than the width W6 of the projected line 49. An engaging part 52 fitted in the step part 47 for preventing a friction ring from falling off in the recessed groove 43 is formed on both ends of the foot 51a of the mountain.

In this embodiment, the fitting head part 51 is formed approximately in a cone shape in a cross section, and particularly, is formed in a trapezoidal shape in a cross section. The both side surfaces are guide surfaces 51b for guiding the head part to the recessed groove 43. The top part width W7 of the fitting head part 51 is narrower than the space S1 between the fitting projection parts 45, and the width W5 of the foot 51a of the mountain of the fitting head part 51 is equal to the width W9 of the recessed groove 43.

Therefore, the fitting head part 51 advances into the recessed groove 43 smoothly while the guide surfaces 51b of the both sides are in contact with the fitting projection parts 45. When the fitting head part 51 passes between the fitting projection parts 45, the fitting part 52 of the fitting head

part 51 is fitted in the step part 47 for preventing a friction ring from falling off, and thereby the friction ring 48 can be mounted on the outer periphery of the disk body 42.

In embodiment, as shown in Fig. 8, the top part 51c of fitting head part 51 is in contact with the bottom part 46 of recessed groove 43. However, the top part 51c of the fitting head part 51 may not be in contact with the bottom part 46 of the recessed groove 43.

(Embodiment 5)

A false-twisting disk 61 of embodiment is a modification of embodiment 4. In embodiment 4, the fitting head part 51 is formed approximately in a cone shape in a cross section in the friction ring 48, and particularly, is formed in a trapezoidal shape in a cross section. However, in embodiment, as shown in Fig. 9 and Fig. 10, a fitting head part 63 of a friction ring 62 is formed approximately in a semicircular shape in a cross section.

Since the other configurations are identical to those in embodiment 4, their explanation is omitted as a result of attaching the same reference numerals.

Since outer surface of the fitting head part 63 formed approximately in a semicircular shape in a cross section is a projecting arcuate surface in embodiment, the fitting head

part 63 smoothly advances into the recessed groove 43 while the outer surface is in contact with the fitting projection parts 45 as the guide surface. When the fitting head part 63 passes between the fitting projection parts 45, the fitting part 52 of the fitting head part 63 is fitted in the step part 47 for preventing a friction ring from falling off, and thereby the friction ring 62 can be mounted on the outer periphery of the disk body 42.

(Test)

A polyester filament (raw yarn) of 150 denier was false-twisted with yarn speed of 400m/s and at disk revolutions of 6500rpm by using the false-twisting disks 5, 21, 31, 41 and 61 of embodiments described above. The friction rings 8, 28, 48 and 62 did not fall off from the disk bodies 10, 23 and 42 of the false-twisting disks 5, 21, 31, 41 and 61 at all, and did not deviate from a prescribed position at all.

Industrial Applicability

As described above, the false-twisting disk of the present invention can be used for twisting in the friction false twister for crimping various types of fibers including synthetic fibers such as nylon and polyester.

In addition, as described above, only the friction ring can be replaced in the false-twisting disk of the present

invention, and has an excellent feature that the friction ring can reliably be fixed to the disk body in the high-speed rotation. Thereby, the false-twisting disk of the present invention can be also diverted to a textile machinery other than a friction false twister.